

THE PROBABLE EFFECTS OF THE IRANIAN OIL CRISIS  
ON WORLD SUPPLY AND DEMAND, AND POSSIBLE  
SOLUTIONS TO THE CRISIS

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SOLUTIONS TO THE CRISIS

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## FOREWORD

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## I. INTRODUCTION

The oil crisis has largely dominated the political scene in Iran during 1950 and up to the present time. The eyes of the whole world are on Iran, and the possibility that most or all of the oil production there might be temporarily lost to the free world has created considerable anxiety in many of the world's capitals.

Both upper and lower chambers of the Iranian Parliament have voted for nationalization of oil. The British do not deny the right of Iran to nationalize, but do object strenuously to the form of expropriation.

The scope and purpose of this paper is to summarize the development of the present situation, to estimate the probable effect of the loss of Iranian oil, and to suggest certain actions which might lessen the effect of such loss on the world oil situation.





## II. HISTORY OF OIL DEVELOPMENTS

### A. General Summary

Until recently there were only two oil companies in Iran, the Anglo-Iranian Oil Company, Limited, and the Iran Oil Company.\* The latter was a Government company formed in 1949 to exploit Iran's oil resources in the area not under concession. The Iran Oil Company has been making surveys and plans to drill test wells, but has not yet produced oil.<sup>1</sup>

The Anglo-Iranian Oil Company stems from the D'Arcy Concession, obtained from the Iranian Government in 1901. Oil was struck in 1908 and the following year a company, now known as the Anglo-Iranian Oil Company, was formed to take over the D'Arcy Concession. In 1914 the British Admiralty placed a long-term contract with the company for fuel oil at reduced prices. At the same time the British Parliament authorized the British Government to invest two million pounds sterling in the company, thus acquiring a majority interest which it still retains.

The D'Arcy Concession was cancelled by the Iranian Government in November 1932, and after a series of negotiations a new concession agreement was concluded on April 29, 1933, valid for sixty years. Two important provisions of the agreement limited the area of the new concession to 100,000 square miles and changed the basis of royalty payments from the previous 16 per cent of net profits to a tonnage basis. The operations of the company

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\* Other concessions have been granted in the past, all but one of which, the Kavir Khurian concession, have definitely expired or have been cancelled

<sup>1</sup> References at end of paper



continued to expand until the outbreak of World War II, which brought first a decline and later an increase in the activities of the company.

In October 1947, the Majlis passed a law forbidding the granting of further concessions to foreigners and directing the Government to complete surveys of the oil-bearing areas of the country within five years with a view to exploitation through enactment of appropriate legislation. Receiving impetus from this law, the Government negotiated with Anglo-Iranian in 1948 and 1949 with a view to revision of the 1933 Concession. The Supplemental Agreement, signed in July 1949, provided for substantially increased royalty and tax revenues, annual payment of Iran's share in the company's general reserve, a fixed minimum yearly dividend participation and general reserves payment, and a lump sum for accrued reserves and retroactive payments. The proposed agreement was submitted to the Majlis for ratification, but that body failed to act before it adjourned at the end of the month.

In June 1950, the Majlis appointed a Commission of eighteen deputies to make a study and submit a report. Shortly thereafter the Mansur Government was succeeded by the Razmara Government. The Majlis recessed from August 7 to September 3 and when it reconvened, its Oil Commission began the active study of the proposed agreement.

In late November the Commission, by unanimous vote, reported to the Majlis its recommendations that the agreement be rejected as failing to safeguard the rights of Iran, and that the Government be instructed to reopen negotiations with a view to obtaining better terms. A movement to nationalize the Anglo-Iranian concession had gained momentum in the previous months, and debate in the Majlis became more heated. The Government considered it expedient to withdraw the Oil Bill and this was done by the Minister of Finance in late December. The Majlis then passed a Single Article Law early in January,



1951, rejecting the stand taken by the Minister of Finance, who subsequently resigned under pressure. A few days later, the Majlis approved its Oil Commission's recommendations in principle and instructed it, not the Government, to consider proposals for the solution of the country's oil problems and to formulate, within two months, the nation's oil policy for consideration by the Majlis. Razmara's request that the Majlis and Senate designate representatives for the purpose of consultation with the Government was rejected. This action was approved by the Senate.

On March 7, 1951, Premier Ali Razmara was assassinated by a fanatical member of a brotherhood known as "Fedayan Islam".<sup>2</sup> On March 20, Dr. Mohammed Mossadeq succeeded in having his unconditional oil nationalization program passed by the Parliament by unanimous vote. This was followed by the designation of Mossadeq as Premier. Prior to Razmara's assassination, the Anglo-Iranian Oil Company, in an attempt to forestall nationalization, proposed a transfer of the company's physical operations in Iran to a new British company, in which Iran would be represented, and profits equally shared. This offer was rejected. At the end of April, spokesmen for the British Government expressed a willingness to recognize nationalization, but continued to maintain that expropriation was illegal. On May 8, the Anglo-Iranian informed Dr. Mossadeq and the Minister of Finance that the Company desired arbitration under the terms of the 1933 Agreement. This request was also refused by the Iranian Government.<sup>3</sup>

One requirement of the new nationalization law stipulated that a "Mixed Board" take over the control of the Anglo-Iranian Oil Company in Iran, and among other things check the books of the Company. One of the first demands placed before the company's representatives was that they hand over at once the books of the company and 75 per cent of its net proceeds since March, 1951. This was refused by the company. The company threatened to



close down the industry by removing the British technicians, and the British Government sent a cruiser into the Persian Gulf to protect British lives and assist in the evacuation of the technicians, should this course of action become necessary. In the meantime the oil production has continued to decline and, as of the end of June, 1951, the harbor of Abadan remained cluttered with empty tankers whose captains refused to sign a receipt for oil to the new National Oil Company.





## B. Provisions of the Present Oil Nationalization Law<sup>4</sup>

The present law provides as follows:

1. For the purpose of regulating the execution of the Law of March 20, 1951, which nationalizes the oil industry throughout the country, a Mixed Board shall be formed. This Board shall consist of five members of the Senate and five Deputies of the Majlis to be elected by each of these two Houses, the Minister of Finance or his deputy, and one other person to be elected by the Government.
2. Under the supervision of the Mixed Board, the Government is charged to remove forthwith the former Anglo-Iranian Oil Company from control of the oil industry of the country. Should the Company make its claim for compensation an excuse to forestall prompt delivery, the Government may deposit up to 25 per cent of the current income, less cost of production, in the Bank Melli or in any bank acceptable to both parties to secure the claim.
3. Under the supervision of the Mixed Board, the Government is charged to investigate the lawful and rightful claims of the Government as well as those of the Company, to report its views thereon to the two Houses of Parliament and upon approval to give effect thereto.
4. From March 20, 1951, when the Bill for the nationalization of the oil industry received the ratification of the Senate, the Iranian nation being lawfully entitled to the entire earnings derived from oil and oil products, the Government under the supervision of the Mixed Board, is charged to investigate and check the accounts of the Company; similarly, the Mixed Board must meticulously supervise the exploitation of the oil resources from the date this Law went into effect until the appointment of a Board of Management.



5. As soon as possible, the Mixed Board shall prepare the Charter of the National Oil Company including therein provision for the appointment of a Board of Management and a Board of Technical Experts; such Charter shall be submitted to the two Houses for their approval.

6. For the purpose of gradually replacing foreign technicians by Iranian technicians, the Mixed Board is charged to draw up regulations for the annual selection, through competitive examinations, of students to be sent abroad for education, training and experience in the various branches of the oil industry; these regulations after being approved by the two Houses shall be put into effect by the Ministry of Education. The cost of training these students shall be paid out of the oil earnings.

7. Purchasers of the products of the oil fields from which the former Anglo-Iranian Oil Company has been removed can hereafter purchase annually at current world market prices the same quantities purchased by them annually during the period commencing from the beginning of 1948 up to March 20, 1951. For additional quantities they shall enjoy priority, other conditions being equal.

8. All proposals of the Mixed Board shall be delivered to the Majlis, and if approved by its oil commission the latter shall submit a report thereon to the Majlis for ratification.

9. The Mixed Board must complete its work within three months of the approval of this Law, and submit a report of its actions to the Majlis in accordance with Article 8. Should the Board need a longer period of time it may ask for an extension giving adequate reasons therefor.



### III. IRANIAN PUBLIC REVENUE DERIVED FROM THE PETROLEUM INDUSTRY

#### A. From 1933 to 1950

The Anglo-Iranian Oil Company having been the only producing petroleum company in Iran, all of the Iranian Government's revenues from petroleum operations came from this company.

Direct payments to Iran since 1933 are shown in the following table:<sup>5</sup>

<u>Year</u>	<u>Pounds Sterling (a)</u>
1933	1,785,013
1934	2,159,143
1935	2,191,952
1936	2,828,502
1937	3,444,439
1938	3,307,478
1939-1943	20,270,814
1944	4,463,779
1945	5,623,161
1946	7,130,258
1947	7,104,022
1948	9,172,244
1949	13,489,271
1950 (estimated)	15,954,000 (b)

(a) Includes royalty, taxation, gold premium and 20 per cent dividend participation.

(b) Computation based on estimated royalty tonnage for 1950 of 30 million metric tons (approximately 227 million U.S. barrels) and assumption 20 per cent dividend participation would remain in effect.<sup>1</sup>



## B. Revenue Provisions of 1933 Agreement

The 1933 Agreement provided for the following annual payments:<sup>1</sup>

1. Four shillings on each metric ton of the royalty tonnage, which is defined as petroleum sold for consumption in Iran or exported from Iran.
2. A payment in lieu of taxation consisting of one shilling per ton on the first 6 million tons of the royalty tonnage and nine pence for each ton in excess of 6 million tons.
3. A gold premium payment to compensate for changes in the value of English currency, computed by multiplying both the royalty payment and the payment in lieu of taxes (as computed in 1. and 2. above) by a fraction, the numerator of which is the difference between the London price of an ounce of gold, at the time of the particular payment, and the price of an ounce of gold as specified in the agreement (120 shillings), and the denominator of which is the price specified in the agreement.
4. A sum equal to 20 per cent of the distribution to ordinary stockholders, in excess of 671,250 pounds sterling. This is usually referred to as a participation in dividends, and the figure has remained constant the past few years. Payment of the 20 per cent dividend participation is simultaneous with any distribution of dividends to the ordinary stockholders.





### C. Proposed Increased Payments Under Supplemental Agreement 1949

Under the Supplemental Agreement of 1949, payments would have been substantially increased as shown in the comparison below:<sup>1</sup>

	<u>Pounds Sterling</u>
Total 1948, 1949, 1950 payments under Supplemental Agreement	67,968,410
Retroactive one-time payment as Iran's 20 per cent share of general reserve accumulated to December 31, 1950	<u>5,090,909</u>
Total payments under Supplemental Agreement through 1950	73,059,319
Total payments under 1933 Concession through 1950	<u>38,615,516</u>
Excess of payments under Supplemental Agreement over payments under 1933 Concession	34,443,803



#### D. Other Income<sup>1</sup>

1. Although exact figures are not generally available on revenues from internal taxes and duties on petroleum products, it has been estimated that such revenue in 1950 amounted to 606 million rials, or approximately 19 million dollars.

2. In addition to making direct payments, the Anglo-Iranian Oil Company converted large sums of pounds sterling into rials each year to defray local expenditures, at the official rate of exchange as required by the Iranian Government. In 1950 this amounted to 21,457,104 pounds sterling (1,918,265,098 rials, at the official exchange rate of 89.4 rials to the pound).

The sale by Anglo-Iranian of pounds sterling for rials was, on the surface, merely an exchange transaction representing no income for the Iranian Government. In reality, the Iranian Government was able to and did sell this exchange to importers at a rate in excess of the official rate. A conservative rate of exchange to employ in calculating the gain to the Iranian Government is perhaps 112 rials to the pound sterling. On this basis the gain can be estimated at a minimum of 485 million rials, or approximately 15 million dollars at the official rate of exchange of 32 rials equals one dollar.

3. Other sources of income to Iran were derived from Anglo-Iranian shares owned by the Iranian Government, from personal income taxes levied on Anglo-Iranian personnel, and import duties on Anglo-Iranian imports not considered necessary for operations and therefore subject to duties. It has been estimated that in 1950 these revenues would total 200 million rials, or approximately 6 1/4 million dollars.



The approximate total income to Iran from petroleum in 1950 may be estimated at 2,232,000,000 rials, or approximately 70 million dollars. This does not include gains from the sale by Anglo-Iranian Oil Company of pounds sterling for rial expenditures at the official rate.



#### IV. CONSEQUENCES OF NATIONALIZATION

##### A. Iran

The lightheartedness with which nationalization has thus far been acclaimed in Teheran, as an alternative to much higher annual money payments by Anglo-Iranian, is evidence that the implications of a step that threatens to sever Iranian oil fields and the Abadan refinery from the company's world-wide transportation and marketing organization have not been seriously studied by the proponents of such action. Iran would herself be the immediate and the main sufferer from such an extreme course. The loss of crude oil production can possibly be made up by Anglo-Iranian and other producers from other sources within a short time, but the loss of the exportation of refined products from the Abadan refinery would be a serious blow to Iran, Great Britain, and other Eastern Hemisphere countries. Abadan is the largest refinery in the world, with a daily throughput of approximately 550,000 barrels, and employing about 35,000 Iranians in an area where there is no other industry and no agriculture.<sup>6</sup>

Political and economic chaos would follow any attempt by Iran, as presently expressed by Premier Mossadeq, to run the oil industry itself. Iran lacks both the technical personnel and the necessary shipping, and it is doubtful whether they could procure either anywhere in the world. The loss of income would probably plunge Iran into bankruptcy and civil strife. Iran would then be ripe for formation of a communistic form of government.





## B. Great Britain

Britain gets by far the largest share of her domestic oil directly from Iran, as well as fuel for her navy and merchant marine. While a switch to other sources could eventually be made, any prolonged break in the flow would cause serious trouble.

Another aspect of the problem is that Anglo-Iranian represents one of her largest single overseas revenue-producing investments. The British Government owns 52.5 per cent of the stock of Anglo-Iranian Oil Company. The physical assets of Anglo-Iranian, today, represent an investment of close to one billion dollars.<sup>7</sup>

The amount of tax charged the company by the British Government is supposedly greater than the total amount paid by the company into the Iranian Treasury.

Not the least disturbing aspect of the developments in Iran is that "nationalization" carries with it a unilateral breach of the agreement made in 1933, for a period of 60 years, between the Iranian Government and the Anglo-Iranian Oil Company, an agreement which resulted from the British Government taking the case to the Council of the League of Nations under Article XV of the Covenant of that body. There can be no doubt but that the agreement was entered into freely by the Government of Iran.

Article 21 of the 1933 Agreement provided:

"This concession shall not be annulled by the Government and the terms therein contained shall not be altered either by general or special legislation in the future, or by administrative measures or any other acts whatever of the executive authorities."<sup>8</sup>



The issue is not one of nationalization, since Iran has always owned the oil reserves, but it is one of abrogation of contract. It must be agreed that if sovereign governments are to abrogate contracts unilaterally whenever it suits their purpose, there will be no basis for international commercial relationships. If we are to have a world governed by law rather than by force, it becomes necessary to regard it as no more a limitation on a nation's sovereignty to be required to respect the contracts it has freely made, than to regard it as a limitation on an individual's freedom that he do likewise.

If expropriation is carried out, the Iranian Government is quite unable to pay compensation which, under international law, must be adequate, prompt, and effectively made in acceptable currency.



### C. North Atlantic Treaty Countries

Since it is estimated that 25 per cent or more of Europe's petroleum comes from the Iranian fields, the shutting off of this supply would have a crippling effect both on the economy and the rearming efforts of the Atlantic Pact countries.<sup>9</sup> Not only would fuel supplies for planes, tanks, ships, and military and commercial vehicles be cut, but so would the stockpiling of these fuels for a possible war emergency.

Oil consumption and supply of the Atlantic Powers and of their likely enemies provide many marked contrasts affecting their respective military balance sheets. For both sides oil is one of the key commodities. In any armed conflict with the Soviet Union, the relative position of each side in regard to oil supplies remains of crucial significance.

The broad outline of the present oil picture is fairly well known. On the one side is the United States producing within its own frontiers over 6 million barrels per day<sup>10</sup> (see Table 1, Appendix), importing a further 900,000 barrels a day<sup>11</sup> (see Table 2, Appendix), exporting a relatively small quantity. Canada and Western Europe with rising consumption now need nearly 725,000,000 barrels a year. In the case of Europe all but approximately five per cent must be imported. Over 90 per cent of the oil produced outside the United States, the Soviet Union, and Eastern Europe is in the hands of American or Western European oil companies.<sup>9</sup>

On the other side of the picture is the Soviet Union with a population half as large again as the United States using only about an eighth the volume of oil, nearly all of which is produced within its frontiers, with supplementary supplies obtained from Rumania. China with its 450 million people is virtually without oil.



For both sides, availability of oil in war, like that of other essentials, is governed by transport, manufacturing facilities, steel supplies, and a number of other inter-related matters, while the adequacy of supplies is determined to a large extent by irreducible civilian needs.

A factor which must not be overlooked is that under the Marshall Plan, practically all of the Atlantic Pact countries have converted many of their industrial plants from coal to oil.





#### D. Russia and the Communist Bloc

For years, the Soviets appear to have been striving to soften Iran by continuous propaganda, largely through the small but active underground Iranian Communist Tudeh Party, as well as by unjust accusations against the Iranian Government.

It is not believed that Russia would gain very much oil from the Iranian nationalization. The Russians do not have technicians to spare to operate the Iranian fields and the Abadan refinery if the British are expelled. There is only a single-line railway, with few tank cars, spanning the 800 miles of rugged terrain between Abadan and the nearest port on the Caspian Sea. But the denial of this important source of supply to the West would be an important strategic and psychological victory for the Communists.

If Britain tries to use force in retaining control of the Anglo-Iranian Concession the Soviet Union could, under the treaty of 1921, march her armies into Iran, supposedly to prevent a third power using Iran to re-establish the Czarist regime. Such an action would be difficult to stop and in a comparatively short time Russia would control Iran, and probably Iraq. In any case it would be the first step towards the start of World War III.

The Soviets presumably must be aware that such a military gain would only be of temporary advantage, for they would be unable to hold the oil installations long enough to produce and make use of any worthwhile quantity of oil from the existing Iranian fields. This suggests that the political and infiltration methods of the Russians will probably be continued, and perhaps intensified in Iran, in order to make it increasingly difficult



for the British to operate their concessions and export oil and at the same time maintain friendly relations with the Government, unless the Soviets feel that the loss of oil to the British is worth risking an all-out war.



## V. POSSIBLE SOLUTIONS FOR THE IRANIAN OIL CRISIS

### A. Compromise

Some form of compromise which would allow the Iranian Government to extricate itself from a very ticklish position because of national pride and permit the Anglo-Iranian or a new company to operate the oil industry and thus make adequate compensation for financial loss is the most hoped for solution, in the free world, to the Iranian crisis.

Bringing any oil negotiations to a point of mutual acceptance is going to be very difficult, because Premier Mossadeq is, and has been fervently nationalistic for some time. He was the instigator of the present nationalization law. With the agitation for nationalization being maintained at white heat by the underground communist party, it will take a great deal of clear thinking and level-headedness on both sides to come to an amicable solution.

It is generally admitted that if Anglo-Iranian had taken heed of the rising feeling of nationalism in Iran and had taken some positive steps to meet the justifiable demands of Iran, the present crisis might never have come about. It should have been obvious that when the United States oil concessionaires (ARAMCO) worked out a new agreement with Saudi Arabia, for a 50 per cent of net operating profits, that Iran, as an even bigger producer, would demand at least as favorable a percentage. Aramco's latest revision, signed December 30, 1950, follows much the same pattern as that in effect for several years in Venezuela, where the Government adjusts its income tax to obtain a total income from petroleum developments, including royalty, that is equal to company profits.



In the case of Aramco, under the terms of the agreement the company's gross income will be subject to four classes of deductions:<sup>12</sup>

1. Operating expenses
2. Exploration and development expenses
3. Depreciation
4. Foreign government taxes, including United States income taxes actually paid or payable

Half the remaining net operating revenue becomes the maximum limit of payments of all kinds to the Saudi Arabian Government, including royalty, and the various miscellaneous levies now collected such as import duties, visa fees, and port charges.

An arrangement similar to the foregoing would appear to be an equitable agreement and should be offered by Anglo-Iranian. The Iranian Government must realize that they are unable to obtain technicians to operate the oil industry since the State Department has assured the British Government that no American company will take over operations in Iran. However, as a possible solution, both Iran and Anglo-Iranian might well consider the possibility of having an American concern act as impartial observer to assure that any newly-formed combined company is operating for the best interests of both parties and the oil industry as a whole.

Although the United States does not obtain oil from Iran directly, the loss of that oil to the British and Western Europe would cause a considerable strain on our resources, therefore, it is essential that every effort, both diplomatically and through the oil industry, be made to effect some form of compromise that will ensure the continued flow of Iranian oil to world markets.





## B. Rationing

Rationing of petroleum places a strain on the relationship existing between the industry, public, and government. The government does not like to have rationing and would prefer the companies to make up their own system if it is required. The public has never been happy about rationing. In the United States during World War II, rationing was never popular and brought forth storms of protests. As a result, the rationing program was a makeshift one which changed with each new emergency. In England and most other western European countries rationing was a necessity and has continued in some form or other since the end of World War II.

With the prospect of losing Iranian oil there will undoubtedly be some form of rationing applied, both in Europe and the United States. The Petroleum Administration for Defense has already discussed possible rationing programs, but the industry would prefer to make up the Iranian loss by cooperative action such as pooling overseas facilities, exchange of tankers, etc.

If the controversy between Iran and Anglo-Iranian continues to drag on there will be a period of perhaps a year before the amount of Iranian oil could be made up in increased production and refining capacity, so the prospects of not having rationing are not too bright.



### C. Increased Output

The Anglo-Iranian Oil Company, in association with other companies, has resources in Iraq and Kuwait, as well as in Iran. Through its prospecting subsidiary, the D'Arcy Exploration Company, it is interested in oil-bearing territories in many parts of the world, including Great Britain where it has a small producing oil field at Eakring.<sup>13</sup>

The Kuwait and Iraq production can be stepped up to produce probably half of the Iranian production. In one year from April, 1950 to April, 1951, the production from Kuwait alone was increased by 197,000 barrels. Additional crude can be furnished from the United States and Western Hemisphere sources.

As indicated by Table 3, Appendix,<sup>3</sup> the increase in refining capacity of Great Britain and other European countries could make up the difference from loss of the Abadan refinery. The increase in crude oil distillation in Great Britain alone totaling 349,820 barrels per day; that of France is 223,550 barrels per day; Italy and the Netherlands, each over 100,000 barrels per day.

There must of necessity be some form of reshuffling of world oil distribution to prevent uneconomical cross-hauling. This may be accomplished by cutting off United States imports from the Middle East, which in April, 1951, amounted to approximately 100,000 barrels per day. Such action would require additional production from United States and Western Hemisphere sources, which can be accomplished.



#### D. Alternative Sources of Petroleum

##### 1. Liquified Petroleum Gas, (LPG)

Already, an appreciable fraction of American requirements for petroleum products is being met by the condensation of liquid hydrocarbons from natural gas.

Since 1940, the total demand for LPG has increased tenfold to an annual total of over 3.3 billion gallons in 1950.<sup>14</sup> Of this, nearly 65 per cent went to domestic consumers for space heating, cooking, refrigeration, water heating, and other household and farm purposes, a quantity equal to about one-fifth of the United States consumption of domestic heating oils.

The scope for extending the use of LPG to new fields of application is probably greatest in road transportation. This vast potential field is still in the early stages of commercial exploitation, although LPG is already used in heavy road vehicles, buses and taxis. The fuel is ideal for internal combustion engines. With an octane rating of 100 and above, it can be used in high compression engines. It burns more cleanly than gasoline, reduces the risk of crankcase oil dilution, and results in lower maintenance costs and longer periods between overhauls. A recent order by the Chicago Transit Authority for 500 new propane-fueled buses is significant evidence of the attractions LPG propulsion offers under certain circumstances, where large fleets of vehicles work within a small radius and no widespread supply system is called for.

Another highly desirable field is that of agriculture, which would have the added advantage of diminishing the winter peak demand by constant summer users. On an average a farm tractor consumes up to 2500 gallons per year, about ten times the average consumption in a household, but



so far only about 100,000 tractors, or about three per cent of the total of 3.5 million, are as yet equipped to use LPG.<sup>14</sup>

LPG manufacturers in the United States seem to be well capable of meeting demands by a greatly expanded market. Compared with a production of LPG in 1950 from natural gasoline plants of over three billion gallons, and from oil refineries of one billion gallons, speakers at a recent annual meeting of the American Society of Automotive Engineers ventured to estimate an annual production of LPG by 1960 of no less than 25 billion gallons. This is well over one-third of the present annual consumption of gasoline in the United States.

## 2. Oil Shale

The oil shale reserves of the United States have been estimated conservatively to be about 400 billion tons, which contain approximately 92 billion barrels of recoverable oil.<sup>15</sup> In France, the bituminous shale industry is over 100 years old. The richest deposits lie in central France, at Autun, where the reserves are estimated at 70 million tons, and at St. Hilaire, where they are estimated at some 30 million tons. At St. Hilaire about 1,000 tons are handled daily, by specially devised plants that extract nearly 100 per cent of the potential maximum.<sup>16</sup> In Great Britain only the Scottish shale fields have been commercially exploited. The seams of rich oil content extend over an area of some 75 square miles, and have been mined for production since 1851. The reserves of Scottish oil shales are estimated at between 480 and 880 million tons.

Sweden has an estimated one billion tons of oil shales minable by open pits, and a total reserve of some five billion tons in localities conveniently situated for rail or water transport. The Swedish scientists have been responsible for great inventiveness in oil extraction, in particular, the Ljunstrom method of electrically heating the shale underground by means





of bore-holes a few feet apart. Three months are required to heat the shale before vapor is produced; vaporization then proceeds for about two months.

### 3. Coal

Methods of synthesizing petroleum products from coal, developed by German scientists before and during World War II, are being checked and improved in the research laboratories and demonstration plants of governmental bureaus and private corporations in the United States and Western Europe. If known techniques of producing petroleum products from coal by chemical synthesis were applied to the coal reserve of Great Britain, all British requirements for such products could be met for at least several hundred years.

Such a program, however, will take several years and the expenditure of a great deal of money and materials, before final realization. Nevertheless, it is a program which would eliminate a crisis similar to the one now being encountered, and consequently, one which should be kept uppermost for accomplishment as soon as practicable.



### E. Use of Heavy Fuels

The possibility of satisfactorily using the heaviest grades of fuel is of considerable importance from the supply point of view. Greater flexibility in demand affords greater latitude to the refiner, while the shipping industry will greatly benefit from its ability to draw upon a wider range of plentiful and cheaper fuels.

The demand for distillate fuels is rising rapidly, while the demand for heavy fuel oils is flattening out in the face of the great development of natural gas and in view of the restoration everywhere of ample coal supplies.

The successful use of heavy fuels in marine diesels and gas turbine locomotives has proven beyond a doubt that this fuel can be used at considerable saving in the cost of operation.

Several years' experience with the "Auricula" and many other motor ships have proved the substitution of heavy fuels for diesel oils a complete success. Fuels up to 3,000 seconds viscosity have been burned without difficulty, with adequate provision for fuel preheating and purification, and after slight modifications in engine adjustment. At the present price difference between diesel and heavy fuel oil, the outlay for extra equipment may be recovered through less than one years' saving in fuel costs.<sup>17</sup>

Diesel power, while today universally recognized as perhaps the most efficient form of locomotive propulsion, may not necessarily prove to be the last word in rail traction. More and more of the leading makers of locomotive diesels in Europe, as well as in the United States, are now also intensely interested and are studying the potentialities of gas turbine for rail use. For two years, a 4,800 b.h.p. unit, developed jointly by the General Electric Company and the American Locomotive Company, has been under



trial on freight hauling duties over various routes. Since the summer of 1949, it has been solely in the service of the Union Pacific Railway Company, who have just ordered ten more locomotives of the same type. The turbines will run on heavy boiler oil of bunker "C" grade after starting.<sup>14</sup>

Later projects reveal a significant trend towards the development of gas turbines for operation on pulverized coal. Investigations into this field have been in progress for several years on both sides of the Atlantic, particularly in Great Britain, where research is predominantly focused on pulverized coal, on gas obtainable by the underground gasification of coal, as well as on peat, as potential sources of power for land gas turbine installations, especially power stations.



## VI. CONCLUSIONS

It may be seen from the foregoing, that the Iranian Government's decision to nationalize the oil industry of Iran, which actually amounts to expropriation of the Anglo-Iranian Oil Company's facilities in Iran, has created a world crisis which could possibly lead to World War III.

There is little expectation that Iran alone could operate the oil industry efficiently enough to provide oil products for export, and the availability of foreign technical personnel for such work is not too promising. It has been shown that the monetary loss to Iran if production is lost or declines considerably would amount to about half of the government's revenue. The unemployment figure in Iran would mount by tens of thousands and result in widespread unrest and dissatisfaction, both of which are conducive to the spread of communist ideology. If Iran persists in her decision to try and operate the oil industry alone, economic chaos will result, and probably the government will be overthrown by the communistic Tudeh Party.

The loss to Great Britain will be considerably more than the monetary value in and the income derived from the Anglo-Iranian Oil Company. The most seriously affected by even a temporary shutdown of Iran's production would be Great Britain, Western Europe, North Africa and various Far East countries. These countries depend upon Iran for almost 500,000 barrels daily to fill petroleum requirements.

Any curtailment of production of Iran's facilities, with a total capacity for 550,000 barrels daily, would result in near total loss of that amount of petroleum products to world supply channels. This is not a considerable amount when compared to the total world consumption, but it is the major source of supply to European, Asian and African countries.





The possibility of off-setting loss or sharp curtailment in the flow of Iranian oil has been pointed out. The primary method and the one which will help to retain peace in the world, is compromise. There must be a meeting of the minds, whereby an agreement can be reached between Iran and the Anglo-Iranian Oil Company which provides for continuation of operation of the Iranian oil industry. Such a compromise would have to incorporate acknowledgment of nationalization of Iran's oil industry, and arrange for satisfactory payment to Anglo-Iranian for the value of their investment in Iran. With the nationals of both Iran and England already considerably wrought up over the oil situation, it is going to take a wise, impartial arbitrator, friendly to both states to solve the problem.

If compromise fails, there must be a period of adjustment during which demand will be curtailed until new and increased output can fill the gap in world demand left by the loss or decline in production of Iran. The immediate remedy must be temporary rationing. Since the United States has spent billions of dollars to bring about economic and political stability in the free world, it would appear necessary for the United States to do everything in her power to assure the maintenance of this stability. It may be concluded then, that any rationing will be applied in the United States, where, if less than ten per cent of daily consumption is made available for export, the loss of Iran's output would be eliminated.

Certain steps may be taken by the various companies involved through the loss of their former Iranian source of oil products. These involve pooling of facilities, exchange of tankers, and the elimination of cross-hauls by permitting all available Middle East oil to be sent to Western European refineries rather than importing it into the United States. More than once in the past the oil industry has had to adapt itself to rapidly changing conditions, and it should not be beyond its ingenuity again to master this new situation.



## APPENDIX

Table 1

## WORLD CRUDE OIL PRODUCTION

		<u>Thousands of Barrels Daily</u>	
<u>Country</u>	<u>April, 1951</u>	<u>March, 1951</u>	<u>April, 1950</u>
<u>Western Hemisphere</u>			
Argentina	70.0	70.2	66.7
Bolivia	0.9	1.0	1.7
Brazil	2.0	2.0	0.9
Canada	80.5	79.5	66.8
Chile	1.7	1.7	1.8
Colombia	107.1	107.6	94.0
Cuba	0.3	0.3	0.3
Ecuador	7.3	7.3	7.1
Mexico	200.0	207.2	193.1
Peru	42.5	42.5	39.7
Trinidad	56.5	56.4	56.1
Venezuela	<u>1,689.4</u>	<u>1,678.4</u>	<u>1,441.4</u>
Total	2,258.2	2,254.1	1,969.6
<u>Europe-Africa</u>			
France	5.0	5.0	1.5
Fr. Morocco	1.3	1.3	0.7
Germany	24.6	24.0	21.2
Italy	0.1	0.1	0.2
Netherlands	14.3	15.3	13.7
Egypt	42.4	40.3	43.6
United Kingdom	0.9	0.9	1.2
Total	88.6	86.9	82.1
<u>Middle East</u>			
Bahrien	29.9	30.0	30.0
Iran	565.3	700.1	685.4
Iraq	172.9	169.8	122.2
Kuwait	502.8	375.4	305.5
Qatar	45.0	46.5	30.5
Saudi Arabia	695.1	638.9	465.6
Turkey	0.4	0.4	0.6
Total	2,011.4	1,961.1	1,639.8
<u>Far East</u>			
Br. Borneo	105.0	105.0	80.8
Burma	2.0	2.0	0.5
China	2.2	2.2	1.5
India	5.0	5.0	5.3
Indonesia	150.0	150.0	136.1
Japan	6.0	6.0	5.2
New Guinea	4.8	4.8	4.8
Pakistan	4.0	4.0	3.9
Total	279.0	279.0	238.1
<u>Est. Russia and E. Europe</u>			
	931.1	931.1	855.0
Total Foreign	5,568.3	5,512.2	4,784.6
United States	<u>6,144.0</u>	<u>6,052.4</u>	<u>4,968.4</u>
World Total	11,712.3	11,564.6	9,753.0



## APPENDIX

Table 2

## IMPORTS AND EXPORTS OF THE UNITED STATES

Thousands of BarrelsImports into Continental United States

<u>Crude</u>	<u>April, 1951</u>	<u>March, 1951</u>	<u>April, 1950</u>
Mexico	871	1,049	517
Colombia	1,818	1,504	1,028
Venezuela	8,578	8,550	8,750
Kuwait	1,708	1,724	2,447
Saudi Arabia	1,852	1,152	1,217
Others	314	325	---
Total Crude	<u>15,141</u>	<u>14,304</u>	<u>13,959</u>
Daily Average	505	461	465

Products

Residual Fuel	10,377	10,941	10,528
Other Products	839	748	899
Total Products	<u>11,216</u>	<u>11,689</u>	<u>11,427</u>
Daily Average	374	377	381
Total All Oils	26,357	25,993	25,386
Daily Average	879	838	846

Exports (excludes shipments to territories)

Crude	3,615	2,640	2,969
Gasoline	1,967	1,941	1,911
Kerosene	185	38	39
Distillate Fuel	1,335	773	844
Residual Fuel	982	1,077	958
Lube Oil	1,344	1,534	1,256
Other Products	856	847	496
Total All Oils	<u>10,284</u>	<u>8,850</u>	<u>8,473</u>
Daily Average	343	285	282



## APPENDIX

Table 3

## REFINERY CONSTRUCTION AND EXPANSION PROGRAMS

(Degree of increase in throughput resulting from modernization, additions, and new refineries under construction or projected, in barrels per day of throughput)

<u>Country</u>	<u>Crude Oil Distillation</u>	<u>Thermal or Catalytic Cracking</u>
United States	688,860	640,720
Canada	111,100	68,350
Argentina	78,000	--
Bolivia	8,000	--
Brazil	120,000	14,500
Chile	14,000	--
Colombia	22,500	--
Mexico	76,150	--
Puerto Rico	25,000	--
Trinidad	4,000	--
Uruguay	8,000	--
Venezuela	108,000	--
Belgium	91,000	33,000
Denmark	21,000	--
France	223,550	25,250
W. Germany	94,680	--
Italy	105,620	15,980
Netherlands	103,300	--
Portugal	10,000	7,500
Spain	25,000	12,000
Egypt	24,100	--
Iran		30,000
Iraq	22,400	--
Lebanon	68,000	--
Syria	5,000	--
Saudi Arabia	300,500	--
Turkey	23,000	--
So. Africa	20,000	1,000
Australia	20,000	--
Borneo	50,000	--
Burma	1,000	--
Hawaii	3,000	--
Indonesia	71,000	--
Japan	10,000	3,500
Total	2,555,760	851,900
United Kingdom	349,820	71,000
World Total	2,905,580	922,900





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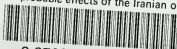
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